

Architect: Tiny House Designer

Performance Task

Introduction

Over the last decade, the Tiny House movement has been spreading. A tiny house is a residential structure under 400 square feet (400 square feet is similar to the size of a two car garage.) The Tiny house movement is becoming more popular because it is more affordable, more environmentally conscious, and just a simpler and easier way of living. Simpler living means less stress and more time to focus on what is important in life.

Teacher Introduction:

This task can easily be modified for several different content areas. Here are some examples:

ELA: Create a tiny house for a specific character/family in a book/novel the students are reading.

Social Studies: Create a tiny house for a specific time period, geographical area or culture.

Science: Create a tiny house that withstands a natural disaster such as hurricane, earthquake, etc. Create a tiny house made of specific materials. Create a tiny house that uses green energy sources.

Math: Possible math extensions could be for students to research costs and create a budget for the house materials, furnishing, and labor, finding the amount of materials used (e.g., the number of roofing shingles or siding), comparing the costs of an average typical house mortgage vs a tiny house mortgage, etc.

Big Idea / Essential Questions

Big Idea

- Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.
- Measurement attributes can be quantified, and estimated using customary and non-customary units of measure.
- Energy can be transferred from one form to another.
- Human decisions related to design, materials, and systems can impact the environment locally and globally.

Essential Questions

- How are spatial relationships, including shape and dimension, used to draw,

construct, model, and represent real situations or solve problems?

- In what ways are the mathematical attributes of objects or processes measured, calculated and/or interpreted?
- How is energy transferred and conserved?
- How do human decisions related to design, materials, and systems can impact the environment?

G.R.A.S.P.

Goal

As a Tiny House Architect, you will be creating a Tiny House Community in your area. A Tiny house is a house whose square footage must be less than 400 sq ft.

Role

You are part of a team of Tiny House architects. You will be informing the public about your new Tiny House Community as well as developing a model Tiny House.

Audience

Your audience is the local community and potential buyers.

Situation

Over the last decade, the tiny house movement has been spreading. A tiny house is a residential structure under 400 square feet. The most popular reasons a person chooses a tiny house include environmental concerns, financial concerns, and the desire for more time and freedom.

As a Tiny House Architect, you and your design team will be creating a Tiny House Community in your area. You will be informing the public about your new Tiny House Community as well as developing a model Tiny House. Remember that a Tiny House is a house whose square footage must be less than 400 sq ft.

Below are a few links to help you with your research as well as links to articles and videos of students in various states who have built Tiny Houses:

- Tiny House Building Checklist: <https://thetinylife.com/ryans-tiny-house/tiny-house-building-checklist/>
- Virtual 3D tours of Tiny Houses: <https://www.tumbleweedhouses.com/virtual-tours/>

Below are links to articles and videos of students who built a Tiny House:

- [Pennsylvania](#)
- [Iowa](#)
- [Georgia](#)
- [West Virginia](#)
- [Colorado](#)

Products

1. Brochure or Infographic

As part of your work, your team is to create an infographic or brochure for the community to inform them about the Tiny House Community. You will need to do some research on Tiny House types, different floor plans, how they are heated/cooled, plumbing, utilities, appliances needed, etc. Include the advantages and disadvantages to living in a Tiny House and why they are becoming more popular.

- What rooms do tiny houses have?
- What are the basic functions that interior space need to provide?
- How can we design spaces to be multifunctional and to efficiently use space?
- How are tiny houses heated and cooled?
- What type of plumbing is used in a tiny house?

Architect: Tiny House - Brochure

Achievement Levels	1	2	3	4
Research (x1)	Product demonstrates a lack of research conducted around the topic.	Product demonstrates that some research was conducted around the topic.	Product demonstrates that research was conducted around the topic using few credible or appropriate sources.	Product demonstrates that thorough research was conducted around the topic using several credible and appropriate sources.
Design (x1)	The brochure or infographic design is unoriginal. Pictures used do not support the important information.	The brochure or infographic design is somewhat original. Few pictures are creatively used with the important information to get the reader interested.	The brochure or infographic design is mostly original. Pictures are creatively used with most important information to get the reader interested.	The brochure or infographic design is original. Pictures are creatively used with the important information to get the reader interested.
Layout (x1)	The brochure/infographic uses few fonts, graphics, attributes making it difficult to understand.	The brochure/ infographic makes use of some appropriate fonts, graphics and attributes making it easy to understand and providing some important information.	The infographic uses sufficient knowledge of fonts, graphics and attributes making it easy to understand providing adequate information.	The brochure/infographic employs a deep knowledge of fonts, graphics and attributes making it visually appealing and easy to understand providing critical information.
Conventions (x1)	Product contains a large number of errors of spelling, grammar, capitalization, and punctuation.	Product contains some errors of spelling, grammar, capitalization, and punctuation. Few sources are appropriately cited.	Product contains few errors of spelling, grammar, capitalization, and punctuation. Some sources are appropriately cited.	Product contains no errors of spelling, grammar, capitalization, and punctuation. All sources are appropriately cited.

2. Scale Model Floor Plan

Your team is designing a model home for the new Tiny House Community. As part of this work, you will need to create a scale model (blueprint) for the model tiny house. This model can be done on graph paper or using technology.

Your first task is to decide the measurements of each room. The square footage of each room should be determined by the approximate amount of time spent in that room - the longer a person will be in the room, the bigger it should be. Remember that the square footage of your house must be smaller than 400 sq ft. Be sure that your floor plan is drawn to scale. Don't forget to include a key for the ratio of the measurements.

Along with the scale model, include a chart that shows the actual dimensions (length, width, height and square footage) of each area so the public can understand the

specific room sizes of the tiny house. Be sure to provide all appropriate units and show all of your math calculations.

- What is the square footage of your tiny home?
- What rooms do you spend the most amount of time in?
- How/where will you store items?

Architect: Tiny House - Floor Plan

Achievement Levels	1	2	3	4
Scale Drawing (x1)	Product is inaccurate as a scale drawing.	Product is a very basic scale drawing with the potential to represent some actual measurements.	Product is an adequate scale drawing that can be used to represent actual measurements.	Product is an excellent scale drawing that can be used to represent actual measurements.
Measurement & Area Calculations (x1)	Product demonstrates minimal understanding of area and linear measurements through inaccurate/incomplete calculations and units.	Product demonstrates some understanding of area and linear measurements through partially accurate calculations and units.	Product demonstrates satisfactory understanding of area and linear measurements through mostly accurate calculations and units.	Product demonstrates thorough understanding of area and linear measurements through accurate calculations and units.
Ratios & Unit Rates (x1)	Product shows a limited understanding of ratios by providing an incorrect unit rate for the scale drawing.	Product shows a basic understanding of ratios by providing a partially correct unit rate for the scale drawing with units.	Product shows a satisfactory understanding of ratios by providing a mostly correct unit rate for the scale drawing with units.	Product shows a complete understanding of ratios by providing a correct unit rate for the scale drawing with appropriate units.
Design Creativity (x1)	Product demonstrates little use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates partial use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates sufficient use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates expert use of creative and innovative thinking throughout the engineering and design process.

3. 3D Model

Your team will need to create a 3D model of your Tiny House so the public can see what it will look like before the model home is built. This 3D model can be designed using materials such as card stock, cardboard, scrap wood, etc or using technology such as Google SketchUp. Your model should be constructed to scale and be sure to include that ratio as a key.

Be sure to include the openings for windows and doors, representations for appliances, utilities, and furniture, as well as areas for storage. If you have a loft or an upstairs, be sure that is part of the model as well. Will the Tiny House have a porch, deck or garden? If so, be sure to include those aspects in your model. Make sure everything in your model is to scale and that the ratio is included.

- Will you have furniture that has more than one purpose?
- Will your Tiny House have more than one floor or a loft?
- How will the people get to the loft or 2nd floor?

Architect: Tiny House - Model

Achievement Levels	1	2	3	4
	Product demonstrates	Product demonstrates some	Product demonstrates	Product demonstrates strong

Achievement Levels	1	2	3	4
Engineering Design (x1)	minimal understanding of the criteria and constraints of the design problem with regard to size, materials, and function of the product.	understanding of the criteria and constraints of the design problem with regard to size, materials, and function of the product.	adequate understanding of the criteria and constraints of the design problem with regard to size, materials, and function of the product.	understanding of the criteria and constraints of the design problem with regard to size, materials, and function of the product.
Mathematics and Modeling (x1)	Images exhibit minimal attention to detail in construction and synthesis of geometric figures to create the products.	Images exhibit some attention to detail in construction and synthesis of geometric figures to create the products.	Images exhibit satisfactory attention to detail in construction and synthesis of geometric figures to create the products.	Images exhibit great attention to detail in construction and synthesis of geometric figures to create the products.
Measurement & Scale (x1)	Product demonstrates minimal understanding ratios and measurements by showing an inappropriate units and scale	Product demonstrates some understanding ratios and measurements by showing partially appropriate units and scale.	Product demonstrates satisfactory understanding ratios and measurements by showing mostly appropriate units and scale.	Product demonstrates thorough understanding ratios and measurements by showing appropriate units and an accurate scale.
Alternate Energy Solutions (x1)	Product shows few or none of the alternate energy sources that will be used for the house.	Product shows some of the appropriate alternate energy sources that will be used for the house.	Product shows many of the appropriate alternate energy sources that will be used for the house.	Product shows all of the appropriate alternate energy sources that will be used for the house.
Creativity & Innovation (x1)	Product demonstrates little use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates partial use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates sufficient use of creative and innovative thinking throughout the engineering and design process.	Product demonstrates expert use of creative and innovative thinking throughout the engineering and design process.

4. Systems Diagram

Construct a diagram that explains either a water or energy system to be used in the house that will minimize the impact of the humans in the house on the environment. This diagram will need to include all of the parts of the systems including inputs and outputs and the overall value of the system for the house, the people living in the house, and the environment.

- How can water and energy be supplied to the house?
- What type of systems would be most economical and why?
- What type of systems would be most beneficial for those living in the house and why?
- What type of systems would be best for the environment and why?

Architect: Tiny House - Systems Diagram

Achievement Levels	1	2	3	4
Minimizing Human Impact on Environment (x1)	The product minimally applies scientific principles to visually design a method for minimizing a human impact on the environment.	The product somewhat applies scientific principles to visually design a method for minimizing a human impact on the environment.	The product adequately applies scientific principles to design a method for minimizing a human impact on the environment.	The product thoroughly applies scientific principles to design a method for minimizing a human impact on the environment.
Systems Flow (x1)	The product does not visually describing the flow of energy into, out of, and through the system to explain the system's behavior.	The product somewhat visually describing the flow of energy into, out of, and through the system to explain the system's behavior.	The product does a sufficient job of visually describing the flow of energy into, out of, and through the system to explain the system's behavior.	The product does an excellent job of visually describing the flow of energy into, out of, and through the system to explain the system's behavior.
	The visualization minimally	The visualization somewhat	The visualization sufficiently	The visualization is a thorough

Achievement Levels	1	2	3	4
Concepts (x1)	demonstrates that the system is an organized group of related objects that can work together in a predictable manner.	demonstrates that the system is an organized group of related objects that can work together in a predictable manner.	demonstrates that the system is an organized group of related objects that can work together in a predictable manner.	demonstration that the system is an organized group of related objects that can work together in a predictable manner.
Diagram Details (x1)	The diagram is minimally supported by labels brief explanation, and symbols necessary to understand how the process flows through the system.	The diagram is somewhat supported by labels, brief explanations, and symbols necessary to understand how the process flows through the system.	The diagram is adequately supported by labels, brief explanations, and symbols necessary to understand how the process flows through the system.	The diagram is thoroughly supported by labels, brief explanations, and symbols necessary to understand how the process flows through the system.

5. Construction Materials Data Table

Create a data table that contains information related to synthetic and natural materials that can be used to construct the house. Research information related to materials that could be used for the outside of the house, to insulate the house, flooring, walls, and cabinets. Within this table include: origin of the material, how the material was developed, benefits and drawbacks of using the materials, impact of the material on the house and the environment, and any other information you believe would be beneficial to help the people building the house to make good decisions.

- What are synthetic materials and how can they be used to construct the house; what are their benefits and concerns?
- What are natural materials and how can they be used to construct the house; what are their benefits and concerns?
- What types of materials would be best for constructing a home and why?

Architect: Tiny House - Materials Table

Achievement Levels	1	2	3	4
Origin of Synthetic Materials (x1)	The product provides a minimal description for how synthetic materials come from natural resources and impact the construction of the house.	The product provides a somewhat describes how synthetic materials come from natural resources and impact the construction of the house.	The product provides a sufficient description for how synthetic materials come from natural resources and impact the construction of the house.	The product provides a thorough description for how synthetic materials come from natural resources and impact the construction of the house.
Attributes of Synthetic Materials and Home Construction (x1)	The product provides little evidence based upon research as to the attributes of natural and synthetic materials and their value in home construction.	The product provides some evidence based upon research as to the attributes of natural and synthetic materials and their value in home construction.	The product provides sufficient evidence based upon research as to the attributes of natural and synthetic materials and their value in home construction.	The product provides strong evidence based upon research as to the attributes of natural and synthetic materials and their value in home construction.
Materials and Potential Impact on Humans and the Environment (x1)	The product is minimally effective in utilizing scientific principles and practical applications of the materials to determine the potential impacts on people and the natural environment that may limit possible solutions.	The product is somewhat effective in utilizing scientific principles and practical applications of the materials to determine the potential impacts on people and the natural environment that may limit possible solutions.	The product is mostly effective in utilizing scientific principles and practical applications of the materials to determine the potential impacts on people and the natural environment that may limit possible solutions.	The product expertly utilizes scientific principles and practical applications of the materials to determine the potential impacts on people and the natural environment that may limit possible solutions.
Organization (x1)	Data table is unorganized and has few labels to help the reader understand the information.	Data table is somewhat organized and has some labels to help the reader understand the information.	Data table is organized and has labels to help the reader understand most of the information.	Data table is very organized and has appropriate labels to help the reader understand all of the information.

6. Systems Flowchart

Your task is to create a systems flowchart based upon the type of energy you believe should heat this tiny house. The drawing should inform the design and development of the prototype device. You will need to construct the prototype so that it can be tested and refined as needed to maximize the heat produced.

- What is the best way to heat a house and why?
- How does heating system produce heat to be used in the house to keep the people the living in the house warm?
- How is heat created for a house through a device?

Architect: Tiny House - Systems Flowchart

Achievement Levels	1	2	3	4
Materials and Potential Impact on Humans and the Environment (x1)	The product is minimally effective in utilizing scientific principles and practical applications to select a heating system that has minimal impact on people and the natural environment that may limit possible solutions.	The product is somewhat effective in utilizing scientific principles and practical applications to select a heating system that has minimal impact on people and the natural environment that may limit possible solutions.	The product is mostly effective in utilizing scientific principles and practical applications to select a heating system that has minimal impact on people and the natural environment that may limit possible solutions.	The product expertly utilizes scientific principles and practical applications to select a heating system that has minimal impact on people and the natural environment that may limit possible solutions.
Creating a Device Maximizing Thermal Energy Transfer (x1)	The products are the result of minimal application of scientific principles to design, construct, and test a device that maximizes thermal energy transfer.	The products are the result of some application of scientific principles to design, construct, and test a device that maximizes thermal energy transfer.	The products are the result of a sufficient application of scientific principles to design, construct, and test a device that maximizes thermal energy transfer.	The products are the result of a thorough application of scientific principles to design, construct, and test a device that maximizes thermal energy transfer.
Research and Development (x1)	The products provide minimal evidence of answers to questions developed to help solve the problem of heating the house in the best way possible.	The products provide some evidence of answers to questions developed to help solve the problem of heating the house in the best way possible.	The products provide adequate evidence of answers to questions developed to help solve the problem of heating the house in the best way possible.	The products provide strong evidence of answers to questions developed to help solve the problem of heating the house in the best way possible.
Visualization of Information (x1)	Visual representation is created in a way that minimally supports the components and the interactions within the system	Visual representation is created in a way that somewhat supports the components and the interactions within the system	Visual representation is created in a way that adequately supports the components and the interactions within the system.	Visual representation is created in a way that strongly supports the components and interactions within the system.